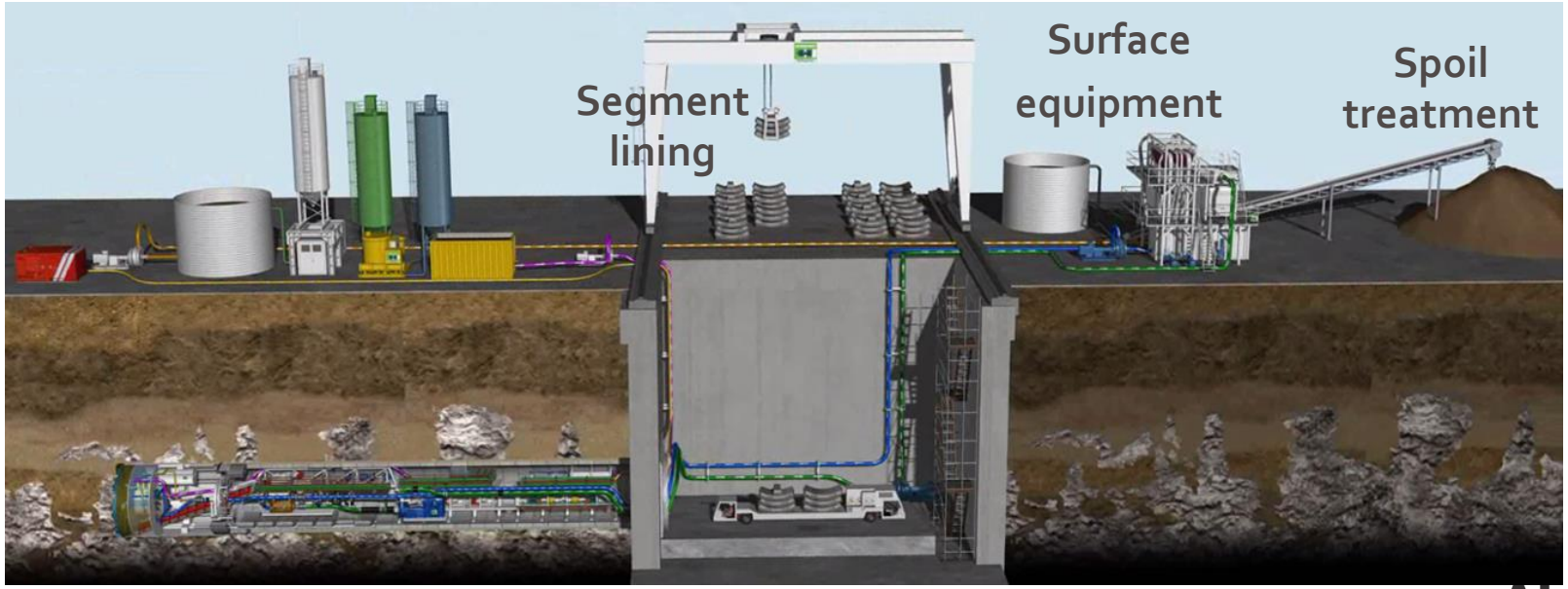
Tunneling methodology and controls

Didier JACQUES

Tunneling methodology

The last generation TBM's are using safe tunnelling technology for heterogeneous grounds

- **Applying and controlling permanently the pressure at face (Excavation chamber),**
- **Full monitoring and supervision system, operating 24/7,**
- **Erecting the segment lining within shield area under atmospheric pressure,**
- **Connected to the portal for logistic supply, spoil disposal,**



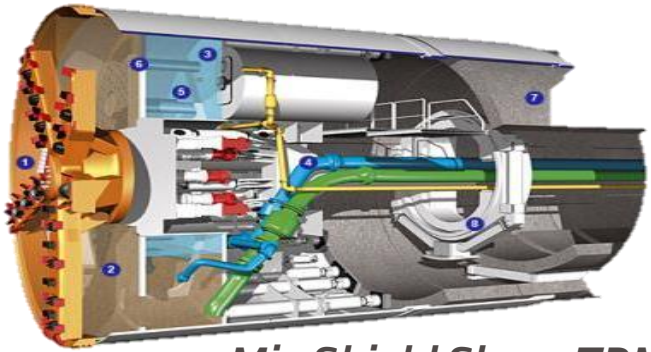
TBM type and process

➢ ***What type of TBM is the most suitable to deal with our geological & hydrological conditions?***

Mix Shield Slurry TBM

- **Process using Bentonite suspension** acting as a support medium, pressurized by an air bubble

- **Why not?**
  - Not fully suitable above water table conditions using very low density in front
  - Not suitable with Open Ground Conditions (Karst & fissures)

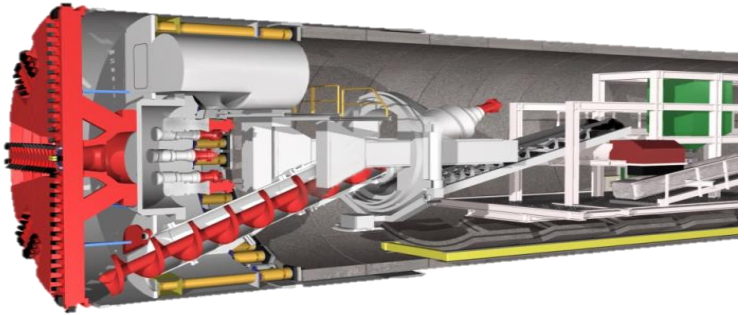


Mix Shield Slurry TBM

Earth Pressure Balance EPB TBM

- **Process using soil Conditioning** making earthy paste pressurized to support excavated face. Use of foam and polymers.

- **Why not?**
  - Not preferable with Open Ground Conditions (Karst & fissures),
  - Use of foam or polymer,
  - Soil treatment for spoil disposal

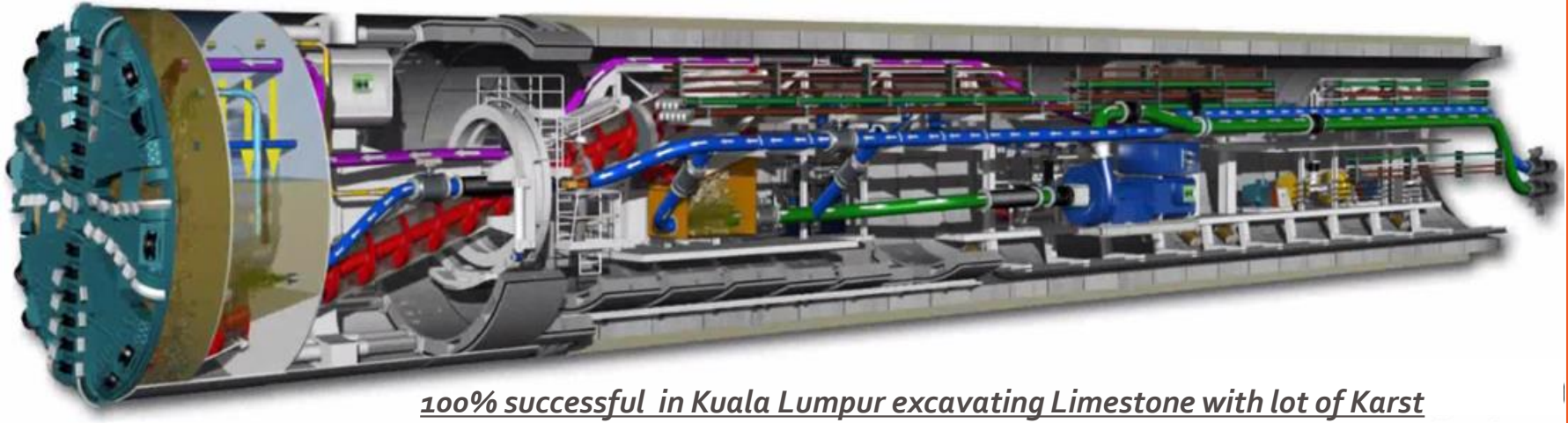


EPB TBM

Variable Density TBM

The Variable Density TBM applies innovative technology by combining the advantages of both methods (Mix Shield + EPB) in one machine.

- **This means that geological and hydro-geological changes along the alignment can be managed flexibly.**



100% successful in Kuala Lumpur excavating Limestone with lot of Karst

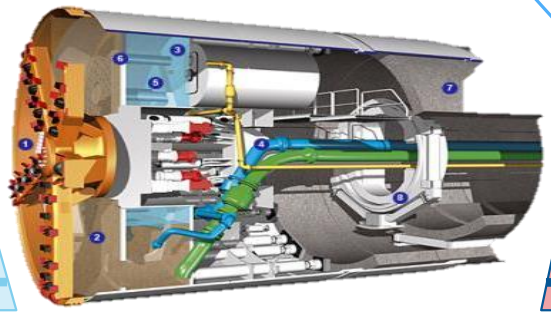
100% successful in Hong Kong in very shallow area less than 6.5 m below roads

Varaible Density working range

→ *We can swap from Low density mode to High density mode immediately on TBM*

Working in low density mode when TBM is deeper & below water table

Light mud in front that can travel in fissures

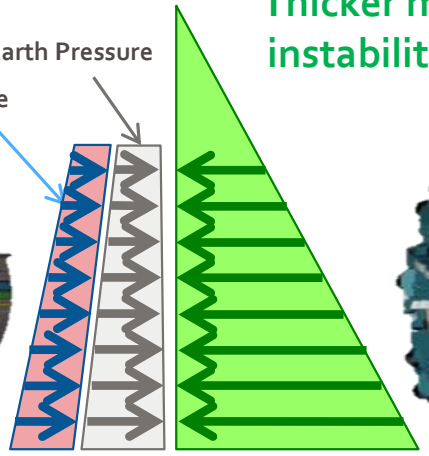


Working in low density mode

~1.1-1.20T/M³

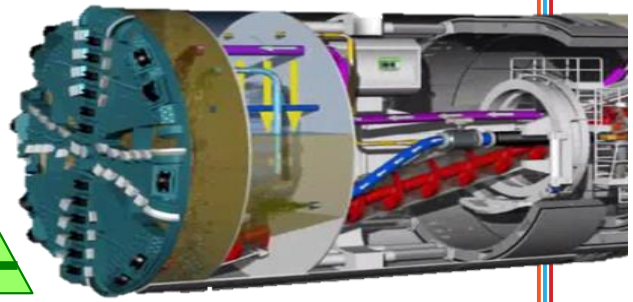
Earth Pressure

Water Pressure



Working in high density mode when TBM is working above water table or crossing bad ground conditions

Thicker mud with no risk face instability in karst or fissures areas



Working in high density mode

~1.30 to 1.60T/M³ max

Dragages HongKong

BOUYGUES

ALIGN